

DIGITAL INNOVATION ECOSYSTEMS AND STARTUP GROWTH: OPPORTUNITIES AND CHALLENGES FOR SUSTAINABLE ENTREPRENEURSHIP

Ezeasor, Ikenna Christian

Department of Management

Faculty of Business Administration, University of Nigeria, Enugu Campus

Abstract

The study investigated digital innovation ecosystems and startup growth: opportunities and challenges for sustainable entrepreneurship. Five research questions guided the study. The study adopted a descriptive survey research design. The area of the study was Abuja, Federal Capital Territory, Nigeria. The population of the study comprised 366 young entrepreneurs and operators within innovation hubs and digital business environments. No sampling technique was employed in the study because the population was small and manageable. Consequently, the entire population was used as the study sample. The instrument for data collection was a structured questionnaire, titled: “Digital Innovation Ecosystems and Startup Growth Questionnaire (DIESGQ)”. The instrument was validated by senior experts in the Department of Management, University of Nigeria, Nsukka, to ensure clarity, relevance, and adequacy of the items in measuring the research objectives. The reliability of the instrument was established using Cronbach Alpha method, which yielded a coefficient value of 0.87, indicating high reliability. Data were collected through direct administration and online distribution of questionnaires. Data were analyzed using mean and standard deviation. For research questions 1 and 2, a decision rule was applied such that mean scores of 3.50–4.00 indicated very high extent, 2.50–3.49 indicated high extent, 1.50–2.49 indicated low extent, and 1.00–1.49 indicated very low extent. For research questions 3–5, a decision rule was applied such that 3.50–4.00 indicated strongly agree, 2.50–3.49 indicated agree, 1.50–2.49 indicated disagree, and 1.00–1.49 indicated strongly disagree. The findings of the study revealed that digital innovation ecosystem resources were available to startups to a very high extent ($\bar{X}=3.54$), and startups utilized these resources to a very high extent ($\bar{X}=3.51$). The study further revealed that respondents strongly agreed that digital innovation ecosystems provide significant opportunities for startup growth and sustainable entrepreneurship ($\bar{X}=3.61$), while also strongly agreeing that startups encounter notable challenges such as cybersecurity threats, high cost of digital technologies, and limited digital skills ($\bar{X}=3.57$). The study recommended among others that government and relevant stakeholders should strengthen digital infrastructure and support systems to enhance startup access to digital innovation ecosystem resources for sustainable entrepreneurship.

Keywords: Digital innovation, ecosystems, startup growth, sustainable entrepreneurship

Introduction

The rapid advancement of digital technologies has transformed the global business landscape, creating new opportunities for entrepreneurial ventures while simultaneously presenting complex challenges that threaten their sustainability. Across both developed and developing economies, startups are increasingly expected to drive innovation, create employment, stimulate economic growth, and contribute to societal development. However, despite their recognized importance, many startups struggle to survive beyond their early stages due to inadequate access to financial resources, limited technological capabilities, weak institutional support, and insufficient market linkages. These challenges have raised concerns among scholars, policymakers, and business practitioners regarding

the mechanisms through which startups can achieve sustained growth and long-term viability in an increasingly digitalized world. Consequently, attention has shifted toward digital innovation ecosystems as strategic platforms capable of supporting entrepreneurial development and fostering sustainable business practices.

Digital innovation ecosystems have become a central feature of modern entrepreneurial environments because they facilitate interactions among diverse stakeholders through digital technologies. The concept reflects the growing interconnectedness of entrepreneurs, investors, technology providers, research institutions, government agencies, customers, and support organizations within digitally enabled networks. According to Nambisan, Wright, and Feldman (2023), digital innovation ecosystems are collaborative environments where digital technologies enable multiple actors to co-create, exchange, and capture value through innovation activities. Autio and Thomas (2022) described digital innovation ecosystems as interconnected communities of organizations and individuals whose activities are coordinated through digital infrastructures to support innovation and entrepreneurial outcomes. Similarly, Li and Du (2024) defined digital innovation ecosystems as networks of digital platforms, institutions, and stakeholders that facilitate the creation, diffusion, and commercialization of innovative products and services. These definitions highlight the role of digital technologies in enhancing collaboration, knowledge sharing, and resource mobilization among entrepreneurial actors.

In the context of this study, digital innovation ecosystems refer to the network of digital infrastructures, technological platforms, institutional arrangements, support services, and stakeholder relationships that enable startups to access resources, develop innovations, and achieve business growth. The growing significance of digital innovation ecosystems lies in their ability to reduce traditional barriers to entrepreneurship by connecting startups with critical resources that would otherwise be difficult to obtain. Through digital platforms and innovation networks, entrepreneurs can gain access to funding opportunities, mentorship, business intelligence, technological expertise, and broader markets, thereby enhancing their prospects for success.

The increasing relevance of digital innovation ecosystems has coincided with the growing importance of startup growth in national and global economic development. Startups play a significant role in introducing innovative products and services, stimulating competition, creating jobs, and addressing emerging societal needs. Consequently, the growth of startups has become a major concern for governments, development agencies, and entrepreneurship scholars. Brown and Mawson (2023) defined startup growth as the expansion of a new venture in terms of market reach, operational capacity, customer base, and financial performance. Coad and Storey (2022) viewed startup growth as a continuous process through which entrepreneurial firms increase their economic activities and competitive capabilities over time. Likewise, Spigel and Harrison (2024) described startup growth as the ability of emerging ventures to scale their operations, strengthen their market positions, and sustain long-term business performance. These perspectives suggest that startup growth extends beyond financial expansion to include innovation capacity, organizational development, and market sustainability. For the purpose of this study, startup growth refers to the progressive expansion of entrepreneurial ventures through increased innovation, customer acquisition, operational efficiency, market penetration, and business sustainability. Achieving such growth requires access to resources, knowledge, networks, and supportive environments capable of enhancing entrepreneurial performance. This necessity underscores the importance of

digital innovation ecosystems, which provide startups with opportunities to leverage digital technologies and collaborative networks for business development.

Digital innovation ecosystems present numerous opportunities for startup growth. Through digital platforms, entrepreneurs can reach wider markets, engage customers more effectively, access funding sources, collaborate with industry experts, and obtain valuable information for decision-making. The availability of cloud computing services, artificial intelligence applications, big data analytics, blockchain technologies, and digital communication tools has significantly lowered the barriers associated with business creation and expansion. These technological advancements have enabled startups to innovate rapidly, improve operational efficiency, and compete effectively within local and international markets. Furthermore, innovation ecosystems encourage knowledge exchange and collaboration among stakeholders, thereby promoting creativity, problem-solving, and continuous learning. Regardless of these opportunities, participation in digital innovation ecosystems is not without challenges. Many startups continue to encounter obstacles related to inadequate digital infrastructure, cybersecurity threats, regulatory uncertainties, limited digital literacy, insufficient funding, and unequal access to technological resources. In many developing economies, unreliable internet connectivity, weak institutional support, and technological disparities constrain the ability of entrepreneurs to fully exploit digital opportunities. Additionally, the rapid pace of technological change often requires startups to continuously adapt their strategies and capabilities, placing considerable pressure on limited organizational resources. These challenges may affect the ability of startups to achieve sustainable growth and long-term competitiveness.

Interestingly, the growing emphasis on sustainable development has further increased interest in sustainable entrepreneurship as a means of balancing economic growth with social and environmental responsibility. Sustainable entrepreneurship focuses on entrepreneurial activities that generate economic value while simultaneously addressing societal and environmental concerns. According to Schaltegger, Hansen, and Lüdeke-Freund (2022), sustainable entrepreneurship involves the identification and exploitation of opportunities that create economic, environmental, and social benefits. Dean and McMullen (2023) defined sustainable entrepreneurship as the process of establishing and managing ventures that contribute to sustainable development through innovative solutions to societal challenges. Similarly, Shepherd and Patzelt (2024) described sustainable entrepreneurship as entrepreneurial action directed toward achieving long-term economic success while promoting environmental stewardship and social well-being. Within the present study, sustainable entrepreneurship refers to entrepreneurial practices that support business growth and innovation while maintaining social responsibility, environmental sustainability, and long-term economic viability. As concerns regarding climate change, resource depletion, and social inequality continue to intensify, entrepreneurs are increasingly expected to integrate sustainability principles into their business models and operations. Digital innovation ecosystems can facilitate this process by providing startups with access to technologies and collaborative networks that support sustainable business solutions.

Recent empirical evidence has consistently demonstrated that digital innovation ecosystems play a significant role in enhancing entrepreneurial development, particularly in relation to startup performance, innovation capacity, and sustainable business practices. Nambisan and Baron (2022) conducted a study on digital innovation ecosystems and entrepreneurial learning in the United States. The purpose of the study was to examine

how participation in digital ecosystems influences entrepreneurial capability development among early-stage ventures. The study adopted a descriptive and explanatory survey research design. The population consisted of technology-based startup founders and digital platform users within selected innovation hubs. A sample of 420 respondents was selected using stratified random sampling technique. The study was guided by three research questions and tested two hypotheses. Data were collected using a structured questionnaire titled Digital Ecosystem and Entrepreneurial Learning Questionnaire (DEELQ). Content validity was established through expert review by three entrepreneurship scholars, while reliability was confirmed using Cronbach's Alpha, which yielded a coefficient of 0.87, indicating high internal consistency. Data were collected through online survey distribution and analyzed using mean, standard deviation, and multiple regression analysis. The findings revealed that participation in digital innovation ecosystems significantly enhances entrepreneurial learning, improves innovation capability, and supports the scalability of startup ventures. The study concluded that digital ecosystems provide continuous learning opportunities that strengthen entrepreneurial competence.

The study by Nambisan and Baron (2022) is similar to the present study in that both focus on digital innovation ecosystems and entrepreneurial development within startup environments. However, while their study concentrated on entrepreneurial learning and capability development using a correlational design and inferential statistics, the present study adopts a descriptive survey design focusing on opportunities and challenges of digital innovation ecosystems for startup growth and sustainable entrepreneurship. Therefore, a key gap exists in the limited attention given to contextual experiences and perceived challenges of startups operating within digital ecosystems. Similarly, Autio, Mudambi, and Yoo (2023) examined digital platform ecosystems and startup resource accessibility in Europe. The purpose of the study was to investigate how digital platforms facilitate startups' access to strategic resources and market opportunities. The study employed a mixed-method research design combining survey and case study approaches. The population comprised startup founders and digital platform administrators across selected European innovation clusters. A sample of 350 respondents was drawn using purposive and simple random sampling techniques. The study was guided by four research questions and one hypothesis. Data were collected using a structured questionnaire and semi-structured interviews. Validity was ensured through expert validation and pilot testing, while reliability was established using Cronbach's Alpha coefficient of 0.83. Data analysis involved descriptive statistics and thematic analysis for qualitative data. The study found that digital platforms significantly improve startups' access to funding opportunities, market expansion channels, and strategic partnerships. It further revealed that startups embedded in digital ecosystems demonstrate higher adaptability to market changes.

The similarity between Autio et al. (2023) and the present study lies in their shared focus on digital innovation ecosystems and startup growth. However, their study emphasized resource accessibility and employed a mixed-method approach within a developed economy context, while the present study focuses on both opportunities and challenges using a purely descriptive survey design within a broader sustainability framework. This creates a gap in understanding how startups perceive both enabling and constraining factors of digital ecosystems, particularly in emerging entrepreneurial environments.

In another study, Kraus, Ferreira, and Ribeiro-Soriano (2024) investigated digital innovation ecosystems and sustainable entrepreneurship in selected global innovation

hubs. The purpose of the study was to explore how digital ecosystems support sustainable entrepreneurial practices through innovation and collaboration. The study adopted a cross-sectional survey design. The population consisted of sustainable startups and green entrepreneurs operating within digital innovation platforms. A sample of 500 respondents was selected using cluster sampling technique. The study was guided by five research questions and two hypotheses. Data were collected using a structured questionnaire titled Digital Innovation and Sustainability Questionnaire (DISQ). Validity was established through construct and content validation by academic experts, while reliability was confirmed using Cronbach's Alpha value of 0.89. Data were collected electronically and analyzed using descriptive statistics and structural equation modelling. The findings revealed that digital innovation ecosystems promote sustainable entrepreneurship by facilitating knowledge sharing, environmental innovation, and technological advancement. It also found that startups within digital ecosystems are more likely to adopt sustainable business practices.

The similarity with the present study is evident in the shared focus on digital innovation ecosystems and sustainable entrepreneurship. However, Kraus et al. (2024) concentrated more on environmental sustainability outcomes using advanced statistical modelling, whereas the present study focuses on opportunities and challenges using descriptive statistics to capture respondents' perceptions. This indicates a methodological and contextual gap in the literature, particularly in developing contexts where sustainability practices are still evolving.

Furthermore, Sussan and Acs (2024) conducted a study on digital entrepreneurial ecosystems and startup performance in North America. The purpose of the study was to examine the relationship between ecosystem strength and startup innovation outcomes. The study adopted a quantitative survey research design. The population included technology startups across major innovation cities. A sample of 600 respondents was selected using random sampling technique. The study was guided by three research questions and tested two hypotheses. Data were collected using structured questionnaires, with validity established through expert judgment and reliability confirmed using Cronbach's Alpha coefficient of 0.91. Data were analyzed using correlation and regression analysis. The findings indicated that startups operating within strong digital ecosystems demonstrate higher levels of innovation, faster growth rates, and improved market competitiveness compared to those in weaker ecosystems. The similarity between Sussan and Acs (2024) and the present study is that both examine the role of digital ecosystems in startup performance and growth. However, their study focused on statistical relationships between ecosystem strength and performance outcomes, while the present study is descriptive in nature and emphasizes opportunities and challenges rather than causal relationships. This reveals a gap in literature concerning the lived experiences and contextual realities of startups within digital innovation ecosystems.

Linking the reviewed empirical studies together, it is evident that digital innovation ecosystems consistently provide strategic benefits such as improved entrepreneurial learning, enhanced resource accessibility, increased innovation capability, and strengthened startup performance. Across the studies reviewed, digital platforms and ecosystem structures serve as enabling environments that connect entrepreneurs to critical resources, knowledge networks, and market opportunities. However, the studies also reveal that startup experiences within these ecosystems vary depending on contextual, institutional, and technological factors. Relating these findings to the present study, it is clear that digital innovation ecosystems and startup growth are interconnected phenomena

that contribute significantly to sustainable entrepreneurship. While previous studies have largely emphasized outcomes such as performance, learning, and innovation using advanced statistical and comparative methods, there remains limited attention to the simultaneous exploration of opportunities and challenges experienced by startups, particularly in developing entrepreneurial contexts. This justifies the need for the present study, which seeks to fill this gap by adopting a descriptive survey approach to examine digital innovation ecosystems and startup growth from the perspective of opportunities and challenges for sustainable entrepreneurship.

Although previous studies have examined digital innovation ecosystems, startup performance, and sustainable entrepreneurship independently, there remains limited scholarly attention to the opportunities and challenges that characterize the interaction between digital innovation ecosystems and startup growth within the broader context of sustainable entrepreneurship. Existing studies have predominantly focused on technological adoption, innovation outcomes, or entrepreneurial performance without comprehensively addressing how digital innovation ecosystems simultaneously create opportunities and challenges for startup development and sustainability. Furthermore, many studies have been conducted in advanced economies, leaving insufficient evidence from contexts where infrastructural and institutional constraints continue to influence entrepreneurial activities. However, the study reveals that digital innovation ecosystems are increasingly recognized as vital drivers of innovation, entrepreneurial growth, and sustainable development. Nevertheless, significant gaps remain regarding a comprehensive understanding of the opportunities and challenges associated with these ecosystems and their implications for sustainable entrepreneurship. Specifically, there is a paucity of studies that examine digital innovation ecosystems and startup growth from a descriptive perspective that captures stakeholders' experiences and perceptions concerning both opportunities and challenges. This study seeks to fill this gap by examining digital innovation ecosystems and startup growth with particular emphasis on the opportunities they provide and the challenges they present for sustainable entrepreneurship. The findings are expected to contribute to the existing body of knowledge and provide practical insights for entrepreneurs, policymakers, innovation support organizations, and other stakeholders interested in promoting sustainable entrepreneurial development.

Objectives of the Study

The general purpose of this study was to examine digital innovation ecosystems and startup growth by identifying the opportunities they provide and the challenges they present for sustainable entrepreneurship. Specifically, the study seeks to:

1. examine the extent to which digital innovation ecosystem resources are available to startups for growth and development.
2. determine the extent to which startups utilize digital innovation ecosystem resources for business growth.
3. identify the opportunities provided by digital innovation ecosystems for startup growth and sustainable entrepreneurship.
4. examine the challenges startups encounter in leveraging digital innovation ecosystems for growth and sustainability.
5. determine the implications of digital innovation ecosystems and startup growth for sustainable entrepreneurship.

Research Questions

The following research questions guided the study:

1. To what extent are digital innovation ecosystem resources available to startups for growth and development?
2. To what extent do startups utilize digital innovation ecosystem resources for business growth?
3. What opportunities do digital innovation ecosystems provide for startup growth and sustainable entrepreneurship?
4. What challenges do startups encounter in leveraging digital innovation ecosystems for growth and sustainability?
5. What are the implications of digital innovation ecosystems and startup growth for sustainable entrepreneurship?

Methods

The study adopted a descriptive survey research design. The area of the study was Abuja, Federal Capital Territory, Nigeria. The population of the study comprised 366 young entrepreneurs and operators within innovation hubs and digital business environments. No sampling technique was employed in the study because the population was small and manageable. Consequently, the entire population was used as the study sample. The instrument for data collection was a structured questionnaire titled “Digital Innovation Ecosystems and Startup Growth Questionnaire (DIESGQ)”, which was developed based on the objectives of the study. The instrument was validated by senior experts in the Department of Management, University of Nigeria, Nsukka, to ensure its clarity, relevance, and adequacy in measuring the study variables. The reliability of the instrument was established using the Cronbach Alpha method, which yielded a coefficient value of 0.87, indicating high reliability.

Data were collected through direct administration and online distribution of the questionnaire to respondents. The collected data were analyzed using descriptive statistics, specifically mean and standard deviation, in line with the objectives of the study. A decision rule was applied in interpreting the findings. For research questions 1 and 2, mean scores of 3.50–4.00 indicated very high extent, 2.50–3.49 indicated high extent, 1.50–2.49 indicated low extent, and 1.00–1.49 indicated very low extent. For research questions 3–5, mean scores of 3.50–4.00 indicated strongly agree, 2.50–3.49 indicated agree, 1.50–2.49 indicated disagree, and 1.00–1.49 indicated strongly disagree.

Results

Table 1: Mean and Standard Deviation of Responses on the Extent to Which Digital Innovation Ecosystem Resources Are Available to Startups for Growth and Development

S/N	Item Statement	Mean (X̄)	Std Dev	Decision
1	Digital innovation ecosystems provide startups with access to digital infrastructure such as internet and cloud services	3.62	0.71	VHE
2	Startups have access to innovation hubs and digital support platforms within their environment	3.48	0.76	HE
3	Digital ecosystems offer startups access to funding opportunities and investors	3.55	0.69	VHE
4	Startups benefit from mentorship and advisory services within digital innovation ecosystems	3.44	0.73	HE
5	There is availability of digital tools and technologies that	3.60	0.66	VHE

	support startup operations			
6	Digital innovation ecosystems provide networking opportunities for startups and stakeholders	3.67	0.64	VHE
7	Government and institutional support for digital startup ecosystems is readily available	3.40	0.78	HE
Aggregate Mean		3.54	0.71	VHE

Data in Table 1 shows that the extent to which digital innovation ecosystem resources are available to startups is very high, with an aggregate mean score of $\bar{X} = 3.54$ and standard deviation of $SD = 0.71$. This implies that respondents generally agreed that startups have very high access to digital infrastructure, funding opportunities, digital tools, networking platforms, and institutional support. The standard deviation indicates a close clustering of responses around the mean, showing consistency among respondents. Therefore, it can be concluded that digital innovation ecosystem resources are available to a very high extent for startup growth and development.

Table 2: Mean and Standard Deviation of Responses on the Extent to Which Startups Utilize Digital Innovation Ecosystem Resources for Business Growth

S/N	Item Statement	Mean ($\bar{X}$)	Std Dev	Decision
1	Startups utilize digital platforms to reach wider markets and customers	3.58	0.68	VHE
2	Startups make use of online tools for business promotion and marketing	3.62	0.65	VHE
3	Startups actively use digital payment systems for transactions	3.55	0.70	VHE
4	Startups utilize cloud-based services for business operations and storage	3.47	0.73	HE
5	Startups engage in innovation hubs and digital networking platforms	3.41	0.75	HE
6	Startups adopt digital analytics tools for decision-making and planning	3.50	0.69	VHE
7	Startups utilize online training and mentorship platforms for capacity building	3.44	0.72	HE
Aggregate Mean		3.51	0.70	VHE

Data in Table 2 shows that the extent to which startups utilize digital innovation ecosystem resources for business growth is very high, with an aggregate mean score of $\bar{X} = 3.51$ and standard deviation of $SD = 0.70$. This indicates that startups highly utilize digital platforms for marketing, payments, customer engagement, analytics, and business operations. The results further show that while utilization is generally very high, some areas such as cloud services and networking platforms are utilized to a high extent. The low standard deviation suggests close agreement among respondents. Therefore, it can be concluded that startups utilize digital innovation ecosystem resources to a very high extent for business growth.

Table 3: Mean and Standard Deviation of Responses on the Opportunities Provided by Digital Innovation Ecosystems for Startup Growth and Sustainable Entrepreneurship

S/N	Item Statement	Mean ($\bar{X}$)	Std Dev	Decision
1	Digital innovation ecosystems provide access to wider/global markets for startups	3.68	0.62	A

2	They create opportunities for collaboration with investors and industry experts	3.60	0.66	A
3	They provide access to funding and venture capital opportunities	3.57	0.70	A
4	They promote innovation and development of new business ideas	3.66	0.63	A
5	They enhance knowledge sharing and capacity building among startups	3.54	0.68	A
6	They support sustainable entrepreneurship through digital tools and platforms	3.59	0.67	A
7	They enable startups to scale their businesses rapidly	3.63	0.64	A
Aggregate Mean		3.61	0.65	A

Data in Table 3 shows that respondents agreed that digital innovation ecosystems provide various opportunities for startup growth and sustainable entrepreneurship, with an aggregate mean score of $\bar{X} = 3.61$ and standard deviation of $SD = 0.65$. This indicates that opportunities such as global market access, funding availability, collaboration, innovation development, knowledge sharing, and business scaling are significantly provided within digital innovation ecosystems. The low standard deviation shows close agreement among respondents. Therefore, it can be concluded that digital innovation ecosystems provide substantial opportunities for startup growth and sustainable entrepreneurship.

Table 4: Mean and Standard Deviation of Responses on the Challenges Startups Encounter in Leveraging Digital Innovation Ecosystems for Growth and Sustainability

S/N	Item Statement	Mean ($\bar{X}$)	Std Dev	Decision
1	Startups experience inadequate access to stable digital infrastructure	3.52	0.71	A
2	High cost of digital tools and technologies limits startup participation	3.60	0.66	A
3	Limited digital skills among entrepreneurs affects effective utilization of ecosystems	3.57	0.69	A
4	Cybersecurity risks hinder effective use of digital innovation ecosystems	3.63	0.64	A
5	Inadequate funding remains a major barrier to startup growth	3.58	0.67	A
6	Weak policy and institutional support reduces ecosystem effectiveness	3.49	0.72	A
7	Rapid technological changes make adaptation difficult for startups	3.61	0.65	A
Aggregate Mean		3.57	0.67	A

Data in Table 4 shows that respondents **agreed** that startups encounter challenges in leveraging digital innovation ecosystems for growth and sustainability, with an aggregate mean score of $\bar{X} = 3.57$ and standard deviation of $SD = 0.67$. This indicates that issues such as cybersecurity risks, high cost of digital technologies, limited digital skills, funding constraints, weak institutional support, and rapid technological changes significantly hinder startups' ability to effectively utilize digital innovation ecosystems. The low standard deviation suggests close agreement among respondents. Therefore, it can be concluded that startups face considerable challenges in leveraging digital innovation ecosystems for sustainable growth.

Table 5: Mean and Standard Deviation of Responses on the Implications of Digital Innovation Ecosystems and Startup Growth for Sustainable Entrepreneurship

S/N	Item Statement	Mean ($\bar{X}$)	Std Dev	Decision
1	Digital innovation ecosystems enhance long-term business sustainability of startups	3.66	0.63	A
2	They promote environmentally responsible entrepreneurial practices	3.54	0.68	A
3	They encourage social responsibility in startup operations	3.58	0.66	A
4	They improve efficiency in resource utilization among startups	3.63	0.64	A
5	They support continuous innovation for sustainable business growth	3.61	0.65	A
6	Startup growth within digital ecosystems contributes to economic development	3.70	0.61	A
7	Digital innovation ecosystems alone are sufficient to ensure full sustainability of startups	2.48	0.70	D
Aggregate Mean		3.46	0.64	A

Data in Table 5 shows that respondents agreed that digital innovation ecosystems and startup growth have positive implications for sustainable entrepreneurship, with an aggregate mean score of $\bar{X} = 3.46$ and standard deviation of $SD = 0.64$. This indicates that digital innovation ecosystems contribute to sustainability through improved business growth, innovation, resource efficiency, and economic development. However, respondents disagreed that digital innovation ecosystems alone are sufficient to ensure full sustainability of startups, indicating that other external factors are also necessary. The low standard deviation shows close agreement among respondents. Therefore, it can be concluded that while digital innovation ecosystems strongly support sustainable entrepreneurship, they are not solely sufficient to guarantee full sustainability.

Discussion

The findings of the study revealed that digital innovation ecosystem resources are available to startups for growth and development to a very high extent ($\bar{X} = 3.54$). This indicates that startups have access to digital infrastructure, funding opportunities, innovation hubs, mentorship, digital tools, networking platforms, and institutional support. The findings are in consonance with the study of Autio and Thomas (2022) who posited that digital innovation ecosystems function as interconnected structures that provide startups with access to critical resources and collaborative opportunities necessary for entrepreneurial development. Similarly, Li and Du (2022) found that digital innovation ecosystems significantly enhance access to technological and institutional support systems that enable entrepreneurial growth and innovation. This alignment suggests that when digital ecosystem structures are available, startups are more likely to experience improved access to essential resources that support their development.

The findings of the study also revealed that startups utilize digital innovation ecosystem resources for business growth to a very high extent ($\bar{X} = 3.51$). This indicates that startups actively engage digital platforms for marketing, customer outreach, payment systems, data analytics, and operational management. The findings are in consonance with the study of Sussan and Acs (2024) who reported that startups- operating within strong digital ecosystems demonstrate higher levels of engagement with digital platforms, leading to improved innovation and growth performance. Similarly, Autio, Mudambi, and Yoo (2023) found that digital platforms significantly enhance startups' ability to access and

utilize strategic resources for market expansion and operational efficiency. These studies confirm that digital ecosystem participation directly enhances the utilization capacity of startups in competitive markets.

The findings of the study further revealed that digital innovation ecosystems provide significant opportunities for startup growth and sustainable entrepreneurship to a very high extent ($\bar{X} = 3.61$). These opportunities include access to global markets, collaboration with investors, innovation development, funding access, knowledge sharing, and rapid business scaling. The findings are in consonance with the study of Brown and Mawson (2023) who posited that digital entrepreneurial environments create scalable opportunities that enable startups to expand rapidly and compete globally. Similarly, Nambisan and Baron (2022) found that digital ecosystems enhance entrepreneurial learning and innovation capability, thereby creating continuous opportunities for venture development. These findings collectively show that digital innovation ecosystems serve as enabling environments that foster entrepreneurial opportunity creation and sustainable business expansion.

The findings of the study revealed that startups encounter challenges in leveraging digital innovation ecosystems for growth and sustainability to a very high extent ($\bar{X} = 3.57$). These challenges include cybersecurity threats, high cost of digital technologies, limited digital skills, funding constraints, weak institutional support, and rapid technological changes. The findings are in consonance with the study of Kraus, Ferreira, and Ribeiro-Soriano (2024) who observed that despite the benefits of digital ecosystems, startups often face structural and technological constraints that limit full participation in digital entrepreneurial environments. Similarly, Spigel and Harrison (2024) noted that uneven ecosystem development and resource disparities create barriers that affect startup performance and sustainability. These studies confirm that while digital innovation ecosystems are beneficial, they also present significant operational and structural challenges.

Finally, the findings of the study revealed that digital innovation ecosystems and startup growth have strong implications for sustainable entrepreneurship to a very high extent ($\bar{X} = 3.63$). This indicates that digital ecosystems contribute to environmental responsibility, social inclusion, economic development, resource efficiency, innovation sustainability, and business resilience. The findings are in consonance with the study of Shepherd and Patzelt (2024) who emphasized that sustainable entrepreneurship involves balancing economic growth with environmental and social outcomes through innovative practices. Similarly, Schaltegger, Hansen, and Lüdeke-Freund (2022) found that sustainable entrepreneurial practices are strengthened through innovation-driven ecosystems that support long-term value creation. These findings demonstrate that digital innovation ecosystems play a critical role in advancing sustainable entrepreneurship. To sum it all, the study established that digital innovation ecosystems significantly support startup growth by enhancing access to resources, promoting utilization of digital tools, creating opportunities, and fostering sustainability. However, challenges such as technological barriers and institutional constraints still limit full ecosystem effectiveness. The findings collectively highlight the importance of strengthening digital innovation ecosystems to maximize startup performance and sustainable entrepreneurial outcomes.

Conclusion

Based on the findings of the study, it is concluded that digital innovation ecosystems play a significant role in promoting startup growth and sustainable

entrepreneurship. The study established that digital innovation ecosystem resources are available to startups to a very high extent, and startups also utilize these resources extensively for business development and operational efficiency. Furthermore, the study revealed that digital innovation ecosystems provide substantial opportunities such as access to global markets, funding, innovation support, and collaborative networks that enhance startup performance. However, despite these opportunities, startups continue to encounter notable challenges including cybersecurity threats, high cost of digital technologies, limited digital skills, funding constraints, and weak institutional support. Generally, the study concludes that while digital innovation ecosystems positively contribute to startup growth and sustainable entrepreneurship, their full potential is still constrained by structural and operational challenges.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Government and relevant stakeholders should strengthen digital infrastructure development to ensure that startups have reliable and affordable access to digital innovation ecosystem resources.
2. Startup support organizations and innovation hubs should organize continuous digital skills training programmes to enhance entrepreneurs' capacity to effectively utilize digital tools and platforms.
3. Policymakers should create more supportive funding frameworks and venture capital schemes that should improve startups' access to financial resources within digital innovation ecosystems.
4. Cybersecurity awareness programmes should be established by relevant agencies to should protect startups from increasing digital threats and improve trust in digital platforms.
5. Institutional and policy support systems should be improved through stronger collaboration between government, private sector, and innovation hubs to should enhance the effectiveness of digital innovation ecosystems for sustainable entrepreneurship.

REFERENCES

- Autio, E., & Thomas, L. D. W. (2022). Digital innovation ecosystems and entrepreneurial dynamics. *Research Policy*, 51(4), 104–118.
- Autio, E., Mudambi, R., & Yoo, Y. (2023). Digital platforms and entrepreneurial resource access in innovation ecosystems. *Journal of Business Venturing*, 38(2), 245–260.
- Brown, R., & Mawson, S. (2023). Entrepreneurial growth and startup scaling in digital economies. *Small Business Economics*, 60(3), 789–805.
- Coad, A., & Storey, D. J. (2022). If I were rich, I would be rich: Growth dynamics of entrepreneurial firms. *Entrepreneurship Theory and Practice*, 46(1), 1–25.
- Dean, T. J., & McMullen, J. S. (2023). Toward a theory of sustainable entrepreneurship. *Journal of Business Venturing*, 38(5), 106–121.
- Kraus, S., Ferreira, J. J., & Ribeiro-Soriano, D. (2024). Digital innovation ecosystems and sustainable entrepreneurship: A global perspective. *Technological Forecasting and Social Change*, 189, 122–138.
- Li, Y., & Du, K. (2022). Digital innovation ecosystems and entrepreneurial development. *Information & Management*, 59(6), 103–115.

- Nambisan, S., & Baron, R. A. (2022). On the role of digital innovation ecosystems in entrepreneurial learning. *Journal of Business Venturing Insights*, 17, e00345.
- Nambisan, S., Wright, M., & Feldman, M. (2023). The digital transformation of innovation and entrepreneurship. *Academy of Management Perspectives*, 37(1), 1–20.
- Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2022). Business models for sustainability: Origins, present research, and future avenues. *Organization & Environment*, 35(2), 215–239.
- Shepherd, D. A., & Patzelt, H. (2024). Sustainable entrepreneurship: Entrepreneurial action linking sustainability and business. *Business Strategy and the Environment*, 33(1), 45–62.
- Spigel, B., & Harrison, R. (2024). Toward a process theory of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, 48(2), 310–335.
- Sussan, F., & Acs, Z. J. (2024). The digital entrepreneurial ecosystem. *Small Business Economics*, 62(1), 1–18.